AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application. The following listing provides the amended claims with deleted material crossed out and new material underlined to show the changes made.

1. (Currently Amended) A method of scaling a bit budget for encoding a digital video picture, said method comprising:

receiving a value identifying a particular relaxation level from a plurality of relaxation values, each relaxation level identifying a different scaling relationship, ~~receiving a plurality of different~~ each scaling relationship[[s]] specifying ~~that specify~~ a plurality of different ways for scaling the bit budget in relation to usage of a decoder buffer~~, the different scaling relationships based on different relaxation levels for encoding the digital video picture, the different relaxation levels corresponding to different levels of concern regarding optimal use of the decoder buffer~~;

~~receiving a value identifying a particular relaxation level;~~

from the plurality of scaling relationships, selecting the scaling relationship that corresponds to the particular relaxation level identified by the received value;

based on [[a]] the decoder buffer usage, scaling the bit budget by using the selected scaling relationship; and

at a rate controller, encoding said digital video picture by using the scaled bit budget[[,]]

~~wherein the receiving of the plurality of scaling relationships, the receiving of the value, the selecting of the scaling relationship, and the scaling of the bit budget are performed by a rate controller~~.

2-14. (Canceled)

15. (Currently Amended) A method of encoding a sequence of video frames, the method comprising:

allocating an initial value for a bit budget for a current frame in the sequence of video frames;

receiving a relaxation control value~~, said relaxation control value~~ specifying a particular scaling relationship from a plurality of scaling relationships for scaling the bit budget in relation to a percentage of memory buffer space used, the scaling performed in order to prevent an underflow or an overflow of the memory buffer;

determining a scale value for scaling the bit budget based on the percentage of memory buffer space used by using the ~~specified~~ particular scaling relationship;

determining a final bit budget for the current frame based on ~~said~~ the scale value; and

at a rate controller, encoding the current video frame using the final bit budget[[,]]

~~wherein the allocating, the receiving of the relaxation control value, the determining of the scale value, and the determining of the final bit budget are performed by a rate controller~~.

16. (Currently Amended) The method of ~~encoding a sequence of video frames as claimed in~~ claim 15, wherein ~~said~~ the received relaxation control value is in a range from 0 to 1, wherein ~~said~~ the determined scale value is in a range from 0 to 1.

17-19. (Canceled)

20. (Previously Presented) The method of claim 15, wherein determining the final bit budget for the current frame comprises multiplying the initial bit budget by the scale value.

21. (Canceled)

22. (Previously Presented) The method of claim 1, wherein a larger relaxation level results in a smaller scaling of the bit budget for the digital video picture.

23. (Previously Presented) The method of claim 1, wherein the bit budget is not scaled when the decoder buffer does not deviate from a target path.

24. (Previously Presented) The method of claim 1, wherein a relaxation level of 0 results in maximal scaling of the bit budget with respect to decoder buffer usage and a relaxation level of 1 results in no scaling of the bit budget regardless of the decoder buffer usage.

25. (Previously Presented) The method of claim 1, wherein the plurality of scaling relationships includes a base scaling relationship when the value identifying the particular relaxation level is 0, wherein the other scaling relationships are derived by using the base scaling relationship and the value identifying the particular relaxation level.

26. (Previously Presented) The method of claim 1, wherein each of the plurality of different scaling relationships maps a plurality of buffer anxiety levels quantifying buffer underflow or overflow to a plurality of scaling values for scaling the bit budget.

27. (Previously Presented) The method of claim 1, wherein a first value identifying a first relaxation level results in selection of a first scaling relationship between the decoder buffer usage and the scaling of the bit budget and a second value identifying a second relaxation level results in selection of a second scaling relationship between the decoder buffer usage and the scaling of the bit budget, wherein the first value results in a greater effect on the scaling of the bit budget with respect to the buffer usage as compared to the second value, wherein the first level corresponds to a greater concern regarding optimal use of the decoder buffer.

28. (New) A method of tracking digital video information complexity, the method comprising:

determining a complexity measure for a current digital video picture, the complexity measure for the picture accounting for a plurality of macroblocks in the picture;

combining the complexity measure for the current digital video picture to a running average complexity measure for a series of digital video pictures in a manner that prevents the current digital video picture from significantly changing the running average complexity measure for the series of digital video pictures; and

at a rate controller, encoding the digital video information utilizing the running average complexity measure.

29. (New) The method of claim 28, wherein the running average complexity is not allowed to change by more than a predetermined percentage.

30. (New) The method of claim 28, wherein the running average complexity is processed by a non-linear smoothing filter.

31. (New) The method of claim 28 further comprising determining a value for the current digital video picture that represents a deviation between the current digital video picture and an average digital video picture in terms of bits needed to encode the current digital video picture for a particular desired visual quality,

wherein encoding the digital video information comprises using the determined value for the current digital video picture,

wherein the determining the value for the current digital video picture is also performed by the rate controller.

32. (New) A non-transitory computer-readable medium storing a computer program which when executed by a processor tracks digital video information complexity, the computer program comprising sets of instructions for:

determining a complexity measure for a current digital video picture, the complexity measure for the picture accounting for a plurality of macroblocks in the picture;

combining the complexity measure for the current digital video picture to a running average complexity measure for a series of digital video pictures in a manner that prevents the current digital video picture from significant changing the running average complexity measure for the series of digital video pictures; and

encoding the digital video information utilizing the running average complexity measure.

33. (New) The non-transitory computer-readable medium of claim 32, wherein the running average complexity is not allowed to change by more than a predetermined percentage.

34. (New) The non-transitory computer-readable medium as claimed in claim 32, wherein the running average complexity is processed by a non-linear smoothing filter.

35. (New) A non-transitory computer-readable medium storing a computer program which when executed by a processor encodes a sequence of video frames, the computer program comprising sets of instructions for:

allocating an initial value for a bit budget for a current frame in the sequence of video frames;

receiving a relaxation control value specifying a particular scaling relationship from a plurality of scaling relationships for scaling the bit budget in relation to a percentage of memory buffer space used, the scaling performed in order to prevent an underflow or an overflow of the memory buffer;

determining a scale value for scaling the bit budget based on the percentage of memory buffer space used by using the particular scaling relationship;

determining a final bit budget for the current frame based on the scale value; and

at a rate controller, encoding the current video frame using the final bit budget.

36. (New) The non-transitory computer-readable medium of claim 35, wherein the scale value is set in a range from 0 to 1, wherein the relaxation value is set in a range from 0 to 1.

37. (New) A non-transitory computer-readable medium storing a computer program which when executed by a processor scales a bit budget for encoding a digital video picture, the computer program comprising sets of instructions for:

receiving a value identifying a particular relaxation level from a plurality of relaxation values, each relaxation level identifying a different scaling relationship, each scaling relationship specifying a plurality of different ways for scaling the bit budget in relation to usage of a decoder buffer;

selecting, from the plurality of scaling relationships, the scaling relationship that corresponds to the particular relaxation level identified by the received value;

scaling the bit budget, based on the decoder buffer usage, by using the selected scaling relationship; and

encoding the digital video picture by using the scaled bit budget.

38. (New) The non-transitory computer-readable medium of claim 37, wherein the plurality of scaling relationships includes a base scaling relationship when the value identifying the particular relaxation level is 0, wherein the other scaling relationships are derived by using the base scaling relationship and the value identifying the particular relaxation level.

39. (New) The non-transitory computer-readable medium of claim 37, wherein each of the plurality of different scaling relationships maps a plurality of buffer anxiety levels quantifying buffer underflow or overflow to a plurality of scaling values for scaling the bit budget.

40. (New) The non-transitory computer-readable medium of claim 37, wherein a first value identifying a first relaxation level results in selection of a first scaling relationship between the decoder buffer usage and the scaling of the bit budget and a second value identifying a second

relaxation level results in selection of a second scaling relationship between the decoder buffer usage and the scaling of the bit budget, wherein the first value results in a greater effect on the scaling of the bit budget with respect to the buffer usage as compared to the second value, wherein the first level corresponds to a greater concern regarding optimal use of the decoder buffer.